Facial Trauma: A Retrospective Study of 1262 Patients

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Abstract

Introduction: Traumatic injuries are the leading cause of death among <40 year olds, a good part of the working age population. Traumatic injuries are also the leading cause of lost productivity, causing more lost working days than cancer or vascular cardiomyopathy. **Materials and Methods:** We retrospectively and statistically analyzed the characteristics of facial fractures treated between June 2010 and December 2016 at the Maxillofacial Adult Surgery Unit, Spedali Civili Brescia, Italy. **Discussion:** Facial fractures are common in polytrauma patients, due to exposure of the cephalic end. The incidence of concomitant facial injuries with major trauma is 15%–24% in England (between Liverpool and London) and up to 34% in Washington, based on a large database of 87,174 patients. High-energy trauma frequently involving multiple traumatic injuries often leads to complex facial fractures, affecting different portions of the splanchnocranium. **Conclusions:** Treatment of facial fractures often focuses on functional or esthetic outcomes, and the outcomes are often substantially worse than those of other trauma treatments. Given the esthetic value of the face, facial trauma often leads to heightened emotional distress.

Keywords: Facial, fracture, mandible, maxilla, zygoma

Introduction

Facial fractures vary in type, severity, and cause, depending on the population studied[1] and are influenced by geographical area, cultural differences, lifestyles, and economic trends.[2] An understanding of the causes, severity, and temporal distribution of facial trauma injuries can help identify clinical and research priorities, promoting the implementation of effective preventive measures. Collection of data over time is important.[3] Analyses of both prospective and retrospective data can yield information on current trends in facial trauma treatment.[4]

Facial trauma is a major public health concern, both physically and psychologically, and has major socioeconomic consequences in terms of the costs of hospitalization and treatment and loss of income.[5,6]

We retrospectively analyzed facial fractures that were treated from June 2010 to December 2016 at U. O. Maxillofacial Adult Surgery Unit, Spedali Civili Brescia, Italy (Brescia Maxillofacial Surgery Unit).

Materials and Methods

Our study was based on patients suffering from facial trauma who were evaluated at the Brescia Maxillofacial Surgery Unit during the period between June 2010 and December 2016. Participants included in the study met all of the following criteria:

- Both monotrauma and polytrauma patients, who were subjected to a clinical and radiological evaluation that highlighted signs of at least one fracture of the facial bones
- Treatment conducted through open or closed surgery, excluding patients who did not require intervention or only required follow-up
- Surgery carried out at the Brescia Maxillofacial Surgery Unit between June 2010 and December 2016.

Using these criteria, 1262 patients were selected. For each patient, we considered the following variables:

- Year and month of admission and duration of stay
- Age and sex of the patient
- Etiology of the trauma
- Specific location and number of fractures
- Presence of wound requiring sutures

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- Facial Injury Score System (FISS) score, used as an index of facial trauma severity
- Type of treatment given.

Data were grouped and analyzed using an Excel spreadsheet. In addition, statistical analyses of quantitative data were performed using R-Studio software.

Due to the retrospective nature of this study, the institutional review board of the University of Spedali Civili Brescia granted a written exemption.

Results

We used statistical analysis and multivariate model to represent the number of days of hospitalization, according to patient characteristics and the severity of fractures.

Response variable = "days of hospitalization."

Explanatory variables = "sex," "age," "number of fractures," "FISS score."

Software used: R-Studio [Figure 1].

As shown in Figure 1, the distribution of the response variable was strongly asymmetric and far from a normal standard distribution. The minimum number of days of hospitalization was 2 and the maximum was 85, with an average of 7 days; 75% of patients were hospitalized for a maximum of 3 days.

Using bivariate descriptive analyses, we investigated the presence of relationships between these variables. In these analyses, the average duration of hospitalization was 6.8 days for men and 7.73 days for women. However, the boxplots indicated that there were no strong correlations between the two variables, i.e., the distributions of "days of hospitalization" and "sex" were the same. We also note the presence of numerous anomalous observations (outliers) outside the box [Figure 2].

Scatterplot analyses indicated linear correlations between the number of fractures and the FISS score [Figure 3]: As the number of fractures increases, the FISS score increases. There were also linear correlations between the number of days of hospitalization and both the number of fractures and the FISS score. However, there was not a linear relationship between the number of days of hospitalization and age.

Next, correlation indexes between the variables were calculated. There were strong correlation indexes (41.83% and 45.94%, respectively) between the response variable (days of hospitalization) and the number of fractures and FISS scores (explanatory variables). On the other hand, the correlation index between days of hospitalization and age was very low (15.12%).

We performed the same analyses using contingency tables. The quantitative variables were reduced into classes, and a double-entry table was created. The results indicated a moderate connection between the two phenomena.

As shown in Figure 3, there was a clear association between the two variables. For example, when the FISS score was ≤3, the hospitalization period was nearly always <6 days. For the five patients with an FISS score >12, the hospitalization period was never <10 days. Hence, a low FISS score corresponded to a shorter duration of hospitalization and vice versa. The conditional boxplots shown in Figure 4 also demonstrate this relationship.

Next, we assessed the potential correlation between number of fractures and number of days of hospitalization. We found that a low number of fractures corresponded to a shorter hospitalization period, and vice versa, as shown in Figure 5.

Next, we conducted multivariate linear regression models. Model 1 was a simple linear regression model. Based on the R value, the regression coefficient associated with the "sex" variable was close to zero, i.e., the sex of the patient did not affect the number of days of hospitalization. In other words, as shown in the bivariate analyses, the average number of days of hospitalization was equal between the sexes (all other variables being equal). On the other hand, age, number of fractures, and FISS score had statistically significant effects on the number of days of hospitalization. However, because

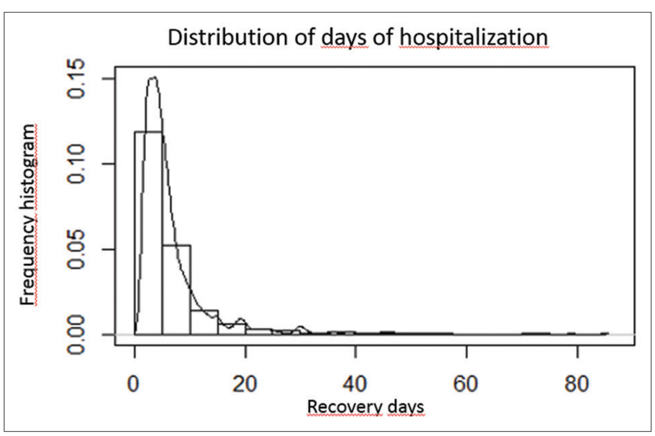

Figure 1: Distribution of the length of hospitalization (days)

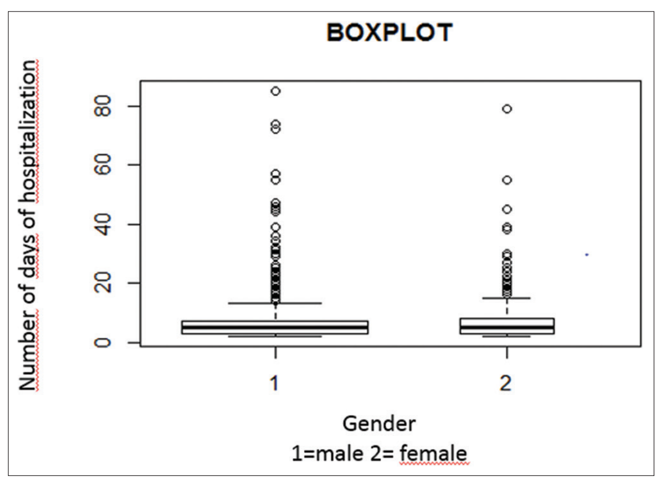

Figure 2: Blogspot 1

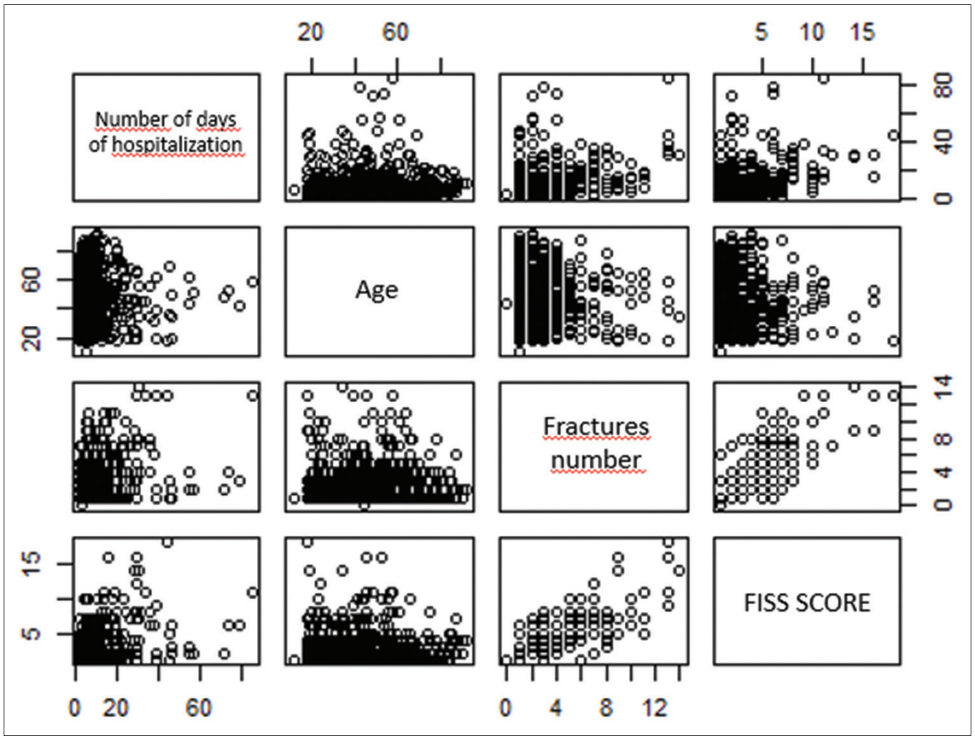

Figure 3: Scatterplot

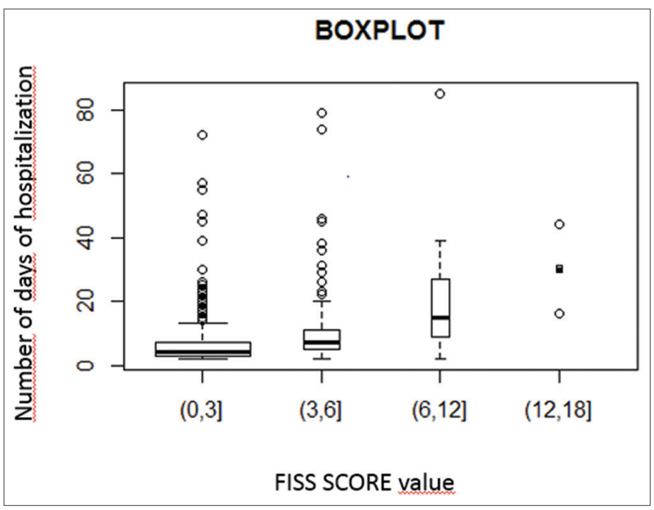

Figure 4: Blogspot 2

the model's goodness of fit index was only 24%, the model did not fit the data well.

Interpretation of the model coefficients

Age: the number of hospitalization days increased by 6% with each 1-year increase in age.

Number of fractures: with each unit increase in the number of fractures while all other variables retained the same values, the average number of hospitalization days increased by 64%.

FISS score: with each unit increase in the FISS score while all other variables retained the same values, the average number of hospitalization days increased by 1.44.

Model 2 was a Poisson model, which is useful for interpreting a discrete quantitative variable response (such as the number of days of hospitalization); it is also useful when the distribution differs from that of a standard distribution. In this model, all R values were significant, i.e., all of the explanatory variables explained the variable response.

Interpretation of the model coefficients

Gender: the average number of hospitalization days was 9.46% greater among women than among men.

Age: with each 1-year increase in age, the average number of hospitalization days increased by 0.88%.

Number of fractures: with each unit increase in the number of fractures, the average number of hospitalization days increased by 5.82%.

FISS score: with each unit increase in the FISS score while all other variables retain the same values, the average number of hospitalization days increased by 12%.

Discussion

The incidence, etiology, clinical presentation, and characteristics of facial fractures are influenced by sociodemographic, economic, and cultural factors.[6-8] In this study, we retrospectively analyzed epidemiological facial fracture data from the province of Brescia, Italy.

The 1262 patients presented with 2615 fractures, all of which were treated. In total, 1003 (79%) patients were male and 259 (21%) patients were female; the male:female ratio was

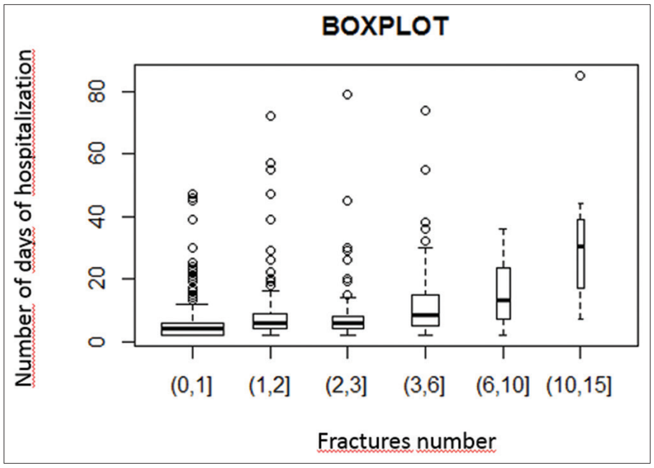

Figure 5: Blogspot 3

3.87:1. The mean patient age was 40.7 years; on average, women were older than men (46.5 and 39 years, respectively). Most admissions were at the beginning of summer (June) and at the end of summer (September).

The average duration of hospitalization was 7 days (males, 6.8 days; females, 7.7 days). In all cases, 299 (24%) injuries were of unknown cause; the other injuries were caused by road accidents (*n* = 252; 20%), aggressive encounters (*n* = 182; 14.4%), sports (*n* = 178; 14.1%), nonroad accidents (*n* = 169; 13.4%), domestic accidents (*n* = 72; 5.7%), other causes (*n* = 30; 2.4%), and iatrogenic causes (*n* = 6; 0.5%).

The site most frequently affected was the middle third of the face (1986 fractures), followed by the jaw (516 fractures), teeth (68 fractures and avulsions), and upper third of the face (45 fractures). In the middle third of the face, the orbitozygomatic complex was the most common fracture site (38%). The most frequent mandibular fracture site was the parasymphysis (22%). Avulsions and dental fractures principally affected maxillary elements. Most frontal bone fractures were comminuted.[9]

Trauma scoring can aid prognosis.[10] The Abbreviated Injury Scale (AIS), based on anatomy, was proposed in 1971, and has been revised several times.[11] In 1974, Baker *et al*.[12] showed that the severity and mortality of trauma cases are reflected by the sum of the squares of the three highest AIS scores for three different regions of the body (in both mono- and polytrauma cases) and proposed an Injury Severity Score (ISS). The AIS–ISS system has achieved global application as an index of survival. Mortality after facial trauma is low, but irreversible facial damage (both esthetic and functional) can cause permanent psychological distress and physical disabilities.[13] Because the AIS–ISS system is primarily an index of survival, it cannot be used to comprehensively assess the severity of facial trauma.[10] Several maxillofacial scoring systems are available, but none are as widely used as the AIS–ISS system.[10] Catapano *et al*.[14] developed the FISS system in 2010. However, it lacks detail and does not distinguish between simple and complex fractures. A system that accurately evaluates all types of facial fractures is not yet available; so, experience and expert judgment are essential. It is not yet known which scoring systems are most compatible with expert opinion.[10] In this study, we calculated the FISS score for each patient, which correlated with the duration of hospitalization; as the FISS score increased by 1, the average duration of hospitalization increased by 12%. Thus, the FISS score can be used to assess trauma severity and to make a prognosis.

Conclusions

The variables that were most closely correlated with hospitalization duration were the number of fractures and the FISS score, which are in turn related to each other. Regarding the significance of these variables, linear regression modeling indicated that sex was not statistically significantly associated with the length of hospitalization. The number of fractures and the FISS score are good indicators of the length of hospitalization.

The data should be incorporated into a common European database, such as that of the European Maxillofacial Trauma project.[15-17]

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Nil.

Conflicts of interest

There are no conflicts of interest.

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